

A Work Project presented as part of the requirements for the Award of a Master's degree in Management from the Nova School of Business and Economics.

DIGITAL TRANSFORMATION IN THE INSURANCE INDUSTRY: APPLICATIONS OF
ARTIFICIAL INTELLIGENCE IN FRAUD DETECTION

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ABSTRACT

The insurance industry has always been a crucial part of the economy and society's progress worldwide. However, it is currently facing an unprecedented scenario composed of high risks and opportunities. This study aims to explain and analyze the process of digitalization in this sector and what are the available applications of artificial intelligence for fraud detection in claim management. It also comprehends a discussion about Brazil, with recommendations that were validated with local professionals from major players in the industry. Hence, the methodological approach chosen for this study was a combination of the qualitative method, essentially based on the review and analysis of academic literature and reports, with important interviews. Lastly, it was concluded that most insurance companies are still at the beginning of the digitalization process, seeking a better understanding of its landscape. Consequently, A.I. applications are slowly being implemented by some large insurance companies.

Keywords

Insurance, Digital Transformation, Technology, Artificial Intelligence, Claim Management, Fraud, Fraud Detection.

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1. INTRODUCTION

The insurance industry has been an important player in our society for centuries, and it works towards loss mitigation and compensation for banks, businesses, and individuals. Private people mostly purchase an insurance product for two reasons: either to mitigate the risk of a financial burden from damages resulting from a certain event, or when they want to reduce life risks such as mortality or disability. Hence, the insurance industry supports individuals by insuring their financial situation, whether offering auto insurance to prevent financial loss from a car accident or life/pension insurance helping the insured to save money regularly to invest in a financial reserve. Thus, this industry fosters investments and consumption by preventing unnecessary precautionary savings and reducing the amount of capital spent in case of an accident. (Hoppe 2012)

Following the same reasoning for companies in general, insurance products enable them to transfer the risks they would possibly need to bear instead of investing in new technologies and product innovation. Accordingly, this industry also supports financial stability and encourages trade that results in sustainable economic growth and development. Consequently, insurance is one of the main fields of the economy. (The Sarrica Group 2018) However, as it will be further explained in detail, decreasing traditional revenue streams, technological innovations, new competitor landscapes, and changing customer expectations are calling for significant changes in the traditional insurance business model. In 2015, the World Economic Forum already stated that it is the sector of financial services most vulnerable to disruption. There is significant value in the short and long term if insurers better digitize their current business.

Nonetheless, one of technology's downsides consists of playing a significant role in increasing global risks. Data fraud was categorized number four global risk by probability over a 10-year horizon, in the World Economic Forum's Global Risks Report. (2019) Additionally, insurance fraud is a significant and costly problem for all its stakeholders. Worldwide, it has been

estimated that insurance fraud recognition will increase from USD 2,518 million in 2019 to USD 7,928 million by 2024. (Research and Markets 2019) Only in the United States, this sector comprises around 7,000 insurers that accumulate over \$1 trillion in premiums every year. The total cost of this criminal activity under analysis is expected to be over \$40 billion per year. (FBI 2020)

Today, in the age of digitalization, a growing amount of data is being collected every day due to customers' willingness to share data and the increasing new data sources like social networks and sensors in mobiles, cars, machines and property. Moreover, data storage capacity has increased, and data scientists have unprecedented computing power. Hence, artificial intelligence, combined with the usage of big data, can offer great opportunities for optimizing and enabling new processes. (Deloitte Digital 2017) For claim management, this technology can currently leverage its self-learning capability using insurance historical robust data sets to identify and analyze patterns to enhance the identification of fraudulent claims.

2. LITERATURE REVIEW

Digital technology is transforming how products and services are delivered and influencing customers' expectations toward more personalized and seamless experiences across many markets. However, most of the traditional insurers still lack innovation in their companies' culture. This directed research is a comprehensive analysis of how digitalization is affecting the insurance industry. Additionally, it sought to answer how artificial intelligence has been used to enhance the industry's value chain, mainly focusing on claim management regarding fraud detection. And lastly, it also comprehends a discussion about Brazil, with recommendations that were validated with professionals that work for important companies in the Brazilian insurance landscape. The following definitions play a significant role in the

conducted analysis of this study; therefore, they are essential concepts to be defined within the literature review:

2.1 Insurance

2.1.1 Insurance business model

The fundamental concept of the insurance business model consists in assuming and diversifying risks. Insurers' revenue model encompasses the promise of coverage in case of loss to its clients that in return pay regular premiums. Those monetary payments are reinvested in the financial market as another important source of revenue. Therefore, assessing and pricing the risk to be taken by the insurer is a crucial task regardless the financial amount covered. This process is called underwriting, which consists of conducting research about the degree of risk of each applicant or entity before assuming that risk. Thus, underwriting is an important step for both parties: for the incumbent, it is the process of pricing the insurance contract accordingly with the risk; and for the insured, it helps to set fair premiums. (Ross 2019)

Claim management is an important process of the insurance business model and the focus of this study. It consists of a request by a policyholder to an insurer for coverage in case of policy event. After receiving the claim, the incumbent needs to investigate the request and check for eligibility before indemnifying the client. (Hayes , 2019)

2.1.2 Insurance contract

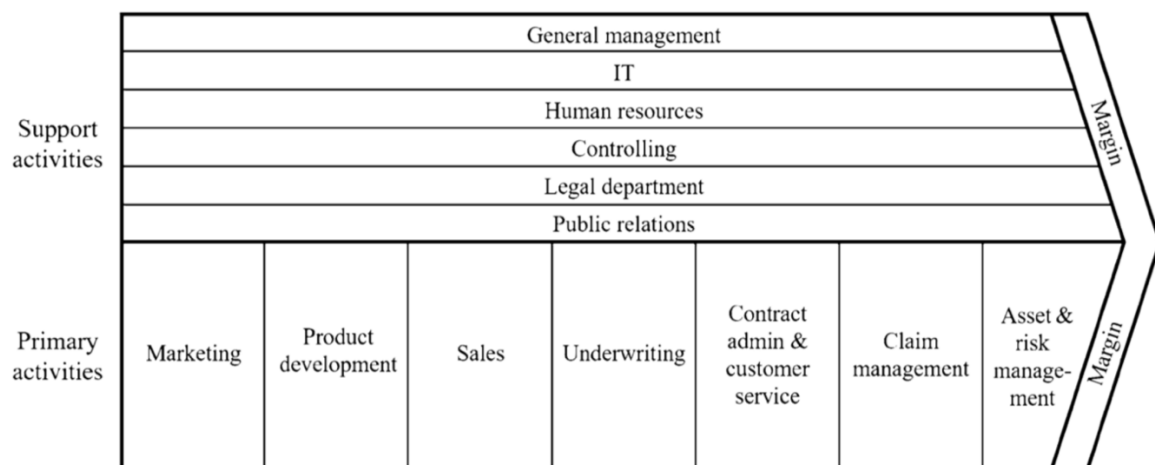
According to the National Association of Insurance Commissioners (2000), an insurance contract consists of an agreement between the insurer and the insured through which the first one agrees to pay money or its equivalent, as an indemnity or reimbursement, in case of loss, injury, or destruction of something. Despite the source of the definition, there are four standard terms regarding the insurance contract. First, insurance represents an agreement between two parties. Second, one party is the insured, that agrees to pay premiums to the second party, the

insurer. Third, the premiums secure the indemnify payment in case of loss. Therefore, the promises of both parties build the basis of the contract. The fourth concept is risk, which distinguishes this type of contract from other contractual relationships.

2.1.3 Insurance value chain

For the purpose of answering the following question “How artificial intelligence has been used to enhance this industry’s value chain?” it was applied the concept of insurance value chain from Eling & Lehmann’ paper (2018), that is an adaptation between Porter’s (1985) value chain broad definition, which discriminates primary and supporting activities a company require to provide a service or product, and Rahlfs’ (2007) insurance-specific value chain. The value chain framework can be used to diagnose and create competitive advantages on both cost and differentiation, which was helpful throughout this study. Thus, Figure I below represent the insurance value chain used for this research.

Figure 1: Insurance-specific value chain



Source: Eling & Lehmann (2018)

2.2 Digitalization & technologies

According to Eling & Lehmann (2018), digitalization can be defined as "the integration of the analog and digital worlds with new technologies that enhance customer interaction, data

availability, and business processes." Their description is a combination of broad and narrow concepts currently available for digitalization, which is adequate for the purpose of this research. Below are descriptions of technologies that will be furthermore discussed in more detail.

2.2.1 Artificial Intelligence

It comprehends the technology innovation that enables computers to learn the ability to complete tasks that usually required human intelligence, such as speech recognition, visual perception and decision-making. It covers the procedure of examining big data with machine learning techniques and automated decision-making according to that data. (Eling e Lehmann 2018) Notwithstanding, A.I. is a set of computational capabilities such as pattern detection, foresight, decision making and interaction. And over the past years, the growth of available data, enhanced computing competencies, and the change in consumers' expectations contributed to its usage increase across different industries, including insurance. (Jones, Humphreys e Woolnough 2019)

Machine learning is one subdiscipline of this technology, which consists of algorithms that learn associations of predictive power from examples in data. Deep learning, neural networks and natural language processing are also sub disciplines of A.I.: the first one is about allowing a machine to receive huge quantities of raw data to learn and improve upon itself for next time, while discriminating between important and irrelevant information from the input. (Panch, Szolovits, & Atun, 2018) Regarding neural networks, they are algorithms designed to replicate the human brain and recognize patterns in data, through identification, classification and analysis of a diverse data. (Shroff , 2019) And natural language processing involves intelligent analysis of written or spoken data; therefore, it attempts to understand natural human communication, and also communicate in return using similar language. It is one of the technologies behind Alexa and Siri, for example. (Hall, 2017) Hence, it's probable that an A.I.

application may involve a combination of its subdisciplines to perform a task and accomplish better results, as the environment of A.I. is constantly progressing.

To conclude, A.I. algorithms when applied to data sets are used for pattern recognition, optimization and prediction. This technology can classify and analyze data in different formats: text, speech, image, video, etc. And it can also work with structured and unstructured data. (Shroff , 2019) Structured data is appropriately formatted; therefore, it is easier to explore and search for it in databases. In contrast to the previous type, unstructured data has no pre-defined format, being challenging to collect, process and analyze. (Pickell , 2018) Hence, the input processed by A.I., that is data, also plays a crucial role on its performance since the better the data excellence, the better the outcomes will be.

2.2.2 Big data

Big data comprises an extensive range of enormous data sets that are practically impossible to manage using traditional business intelligence tools. It can be defined by its 3 distinct V's : (1) volume, regarding the unimaginably large amount of available data that is out there and need to be assessed for relevance; (2) velocity, that is the fast increasing pace at which new data is being generated or the corresponding need for that data to be analyzed; and (3) variety, it defines the huge variety of data varieties. (Jain, 2016) This data can be produced by social networks, telematics devices, or other internet sources. Regarding social networks, which has become the most common online activity since its development, its number of users is projected to grow from 2.95 billion worldwide in 2019 to 3.43 billion in 2023, as shown in Graphic 1 in the Appendix. (Statista , 2020)

2.3 Fraud

The chosen definition of fraud for this study is the one from Robert Longley (2020), “Fraud is a broad legal term referring to dishonest acts that intentionally use deception to illegally deprive

another person or entity of money, property, or legal rights”. Thus, when committing this illegal activity, a person might be looking for monetary or non-monetary resources by intentionally formulating false declarations. In insurance, this criminal act has two source possibilities, it can be done by professionals of this industry, therefore classified as internal, as the case of embezzlement of insurance funds, selling policies without proper license or even obstruction of regulatory investigations. Or it can be done by outsiders, being policyholders, claimants or applicants, hence, classified as external. Furthermore, insurance fraud can be committed during underwriting phase, e.g. through false statements during application to obtain coverage or lower premium, or at claim time, through false or fictitious claims. (Viaene & Dedene , 2004)

This study will mainly focus on external frauds in claims.

3. METHODOLOGY

Throughout this directed research, the focus of the conducted analyses was on the business and economics literature in the risk and insurance field. The methodological approach chosen for this study was the qualitative method combined with interviews in order to validate the conclusion and recommendations. The methodology used on this study consists of three stages: firstly, it was conducted a deep documentary analyses about the following topics: “Insurance market trends”, “Insurance market trends Brazil”, “Digitalization in the Insurance Industry”, “Applications of Artificial intelligence”, “A.I. and insurance fraud detection”, “Insurance fraud Brazil”.

The review of academic literature was done through databases such as Cambridge Journals, EconLit, EconPapers, EU Open Data Portal, Eurostat, OECD iLibrary, ScienceDirect and Statista. And the review of journals was mostly from European Group of Risk and Insurance Economists, The Geneva Association, the American Risk and Insurance Association (ARIA), and the National Association of Insurance Commissioners (NAIC). Later, report analyses were

also made from regular Google search. The documentary analyses aimed to better understand how digital technology is affecting the insurance industry

Secondly, based on the gathered data it was possible to deeply analyze the process of digital transformation and its biggest drivers worldwide. Thirdly, it was conducted a more focused research about digitalization in the insurance industry in Brazil and how large insurers are implementing A.I. in their value chain. Furthermore, five professionals from this industry in Brazil were chosen to be interviewed, in order to validate the conclusions and recommendations developed throughout this study. Those interviewees were selected because of their long experience in their areas of expertise and because they work for important players. Their profile is described on Table 3 and the entire interview is reported on Table 4 in the Appendix.

4. ANALYSIS

Before analyzing how the insurance business is changing due to the implementations of new technologies, it is also important to comprehend the macroeconomic and demographical drivers of this period to better understand the reasoning behind some strategical decisions from large insurers.

4.1 Insurance market trends

Over the past year, due to the current wide scope of globalization, some important events had a negative impact on the average investment rate weakening global growth. Those events were mainly focused on trade tensions between the United States and China, the decreasing Chinese demand, geo-political tensions, Brexit and idiosyncratic risks in some emerging nations. (Bobasu, Geis, Quaglietti, & Ricci, 2020) Hence, the insurance industry is facing an unprecedented combination of high macroeconomic risks and important business opportunities. The economic reality for most countries is defined by low interest rates, stagnant growth and

the rising probability of a global downturn. As insurers derive a huge percentage of their profits from investments in the financial market, the current economic dynamics might undercut a critical source of their profitability. (Santenac , et al., 2019)

In mature markets, the number of insurance policies sold has fallen across both life and non-life segments. In this environment, it is acceptable to expect that insurers would seek cost reduction measures. Nonetheless, at the same time, they cannot cease investments in innovation. Shifting demographics is an additional risk variable, since low birthrates and the projected retirement of baby boomers will confront insurers' financial stability, especially regarding life and health policies. (Santenac , et al., 2019)

Yet, developing countries are presenting opportunities for insurers to overcome the current risks and market threats of the industry, despite their macroeconomic uncertainties. According to Jurado et al. (2015), in this case, uncertainties can be defined as volatilities that impact the macroeconomic forecasts made by professionals in the field. Thus, being able to decrease the propensity for foreign investments and growth. Nonetheless, these opportunities mentioned above derive from their growing middle classes allocating more value to savings due to decreasing changes of governmental pension and other social sponsored programs. Additionally, a growing economy presents more opportunities for new insurance policies sales as they have a high rate of new small and medium enterprises (SMEs) searching for insurance coverage, consequently, also large companies seeking for help to safeguard their businesses from the increasing competition. (Santenac , et al., 2019)

Millennials, the first “digital native” generation, and younger ones are delaying some traditional milestones, such as marrying and buying homes, while general customer expectations are rising, mainly around digital channels and bespoke experiences. Therefore, developing exclusive and tailored customer experiences has been a priority for insurance

companies. However, that indicates that many are still trying and remain vulnerable to non-traditional players. (Santenac , et al., 2019)

4.1.1 Europe

The European insurance ecosystem is the one encountering the biggest challenges around the globe. The complex economic scenario is composed by low interest rates, that is expected to be the new normal in this continent; weak economic growth, which is affecting several countries including strong economies like Germany; geopolitical uncertainty, mainly relative to Brexit; flat productivity; and low inflation. Several markets are on the edge of recession, which leads to a extensive absence of macroeconomic certainty. (Manchester , Santenac, & Russignan, 2019)

In addition, the shifting demographics in Europe, composed by shrinking and aging population, mass retirements, and high unemployment rates among younger generations, comprise a challenging demographic and economic setting to both life and non-life insurers. Nonetheless, European insurers have accessible technologies that enable them to attract new customers from younger generations and develop improved business lines with tailored policies and services which could even increase their engagement. (Manchester , Santenac, & Russignan, 2019)

4.1.2 Asia-Pacific

For insurers across the Asia-Pacific diverse market, it is a time for considerable opportunity, as it contemplates a large percentage of the world's consumer market and some of the fastest-growing economies. However, the macroeconomic environment varies among countries. Increasing trade tensions among nations worldwide, the slowing growth of China and bigger financial instability are some of the current threats faced by this region. Yet,

Customer outlooks regarding digital interactions and experiences are very forward-thinking, which drives innovation. China is currently leading the development from mobile apps to

media platforms, through the creation of new offers and experiences to increase customer engagement. Also, in Thailand and Australia, consumers are also shifting preferences towards digital channels. Therefore, Asia-Pacific insurance companies have already committed to change and innovations across the business, such as cost reduction, digitalization of the sales force and a more effective use of technology, while insurers in other regions are still forecasting needs and expectations of the customer of the future. (Peters, Santenac, & Russignan, 2019)

Nonetheless, population growth in the Asia-Pacific region is slowing down while its population is ageing. However, shifting demographics varies among countries. Japan and South Korea are examples of countries experiencing the previous scenario, whereas South Korea and China have emerging middle class and millennials in the lead of digital adoption. (Peters, Santenac, & Russignan, 2019)

4.1.3 US & Americas

For the United States, Central and South Americas it is a time of challenges but also promising opportunities. As explained previously, low interest rates, flat productivity and political tensions are also undermining the industry's long-term forecasts in the Americas. Notwithstanding, economic growth rates have been higher than in other developed markets and the region does not face the issue of shrinking and ageing population yet. (Majkowski, Santenac, & Russignan, 2019)

Demographics shifts such as millennials' new milestones, present an opportunity for insurers to develop products focused on new customer needs and the expected mass retirement of baby boomers represents a chance for financial wellbeing focused products. Therefore, proactive insurers, around the world, that manage to address their greatest threats and seize the market opportunities may accelerate their growth and avoid lower profitability levels. (Majkowski, Santenac, & Russignan, 2019)

4.2 Digital Transformation in the Insurance Industry

In the past, the insurance business model has presented to be extremely resilient. Complex regulations, the size of incumbents' balance sheets, the underwriting developed abilities, and their customer's database always made it difficult for new entrants to acquire market share. Nevertheless, as society evolves alongside the fast development of technologies, this industry is too beginning to feel the digital effects, as customers' outlooks of value are evolving from basic needs, being good products at fair price, to personalization and seamless experience, emphasizing engagement promotion. (Bain & Company , 2018)

The traditional insurance business is also known for its low customer engagement, since usually the company only engage with its clients during the sale process and in the case of a claim. Moreover, nowadays, the insured still encounter time-consuming processes. Depending on the insurer, these processes vary from buying a new insurance policy to filling a claim or receiving the compensation in case of loss as stated in the contract. Additionally, insurance clients might even pay unfair premiums based on non-tailored policies. Thus, insurers are considered to be in the early stages of digital transformation. (Hall 2017)

The urgent goal must be to meet customers' expectations, which have changed due to digital technology, in order to earn their trust and loyalty. Therefore, digitalization can help incumbents to tackle this issue by fostering customer engagement while offering a technological ecosystem of services, which is also highly valued by millennials. The automobile insurance for instance, on top of the accident and theft coverage, could also offer roadside support, devices and apps that monitor and recompense safe driving conducts. (Bain & Company , 2018)

In the short term, meeting customers' expectations presents an opportunity for insurers to increase revenues, which is aligned with the fact that those companies must reduce their cost

structure, as explained before, based on the current macroeconomic scenario of low interest rates and global economic slowdown trend. Digitalization can provide the means to enable incumbents to eliminate cost across the value chain, as well as increase customer satisfaction. Based on a McKinsey research conducted in 2017, the automation of business processes can reduce the cost of a claim's process by as much as 30 percent. Conjointly with cost reduction, digitalization and data analysis can also present revenue improvement opportunities, as it enables carriers to better know their clients and therefore price and underwrite more precisely, as well as recognize fraudulent claims. (Digital McKinsey , 2017)

Additionally, digitalization can provide incumbents new streams of revenue, such as allowing insurers to evolve from pure risk protectors to risk preventers, since technology provides the opportunity to use real-time monitoring and visualization that predict and help prevent risks, thus increasing the number of customers' information available. Additionally, the power of big data analytics could enable insurers to offer individual risk-based insurance. (Schmidt , 2018) Be that as it may, insurers have competitive advantages to leverage in this sector and maintain its position as the biggest players, when fully implementing the digital culture. Many carriers have centuries of expertise in this sector, consequently, they have the initial trust from prospects and policyholders. And lastly, their robust balance sheets enable them to underwrite large pools of risk. (Digital McKinsey , 2017)

4.3 How A.I. and big data analytics are affecting the insurance industry's value chain?

New technologies are changing the way incumbents interact with their clients and how they adapt to their new expectations and needs. Conventionally, insurance customers needed personal interaction, and this interaction used to be mainly through agents, brokers or even banks, in order for them to obtain product information. Today, most or even all of the needed information is available online for consumer access. They can also compare product's prices

via aggregator platforms and also purchase products online without any personal interaction. (Eling & Lehmann, 2018)

When analyzing the insurance value chain regarding marketing activities, A.I. and the usage of large amount of data can improve customer segmentation, the assessment of the customer's lifetime value and cross-selling potential. For this reason, it enhances tasks such as market and customer research, development of new product ideas, pricing strategy, and advertisement strategies. As in sales, the access to big data can enrich the companies' CRM systems, using data from many new sources such as telematics devices, social network and mobile phones. Additionally, artificial intelligence has a crucial function in the product sale via Chatbot, that is a human like software that uses A.I. technology for customer support or even sales, usually communicating through webpages or apps with built-in chat programs. Hence, those technologies impact tasks such as customer acquisition and retention, product sale and after-sales. (Eling & Lehmann, 2018)

In the application process for an insurance policy, A.I. can automatize the information extraction from submission of documents to improve efficiency, using capabilities such as machine reading on submission of documents, automated information extraction and the creation of structured data extracted for efficient processing. A.I. algorithms are able to enrich statistical models for loss estimation, developing more accurate loss prediction. Therefore, decreasing claim rate, claim frequency and even claim severity. (Xie, 2018)

Another important department of the industry's value chain that has been impacted by these innovations is the underwriting process. Thus, as reported by Shanique Hall, from the Center for Insurance Policy and Research (2017), artificial intelligence has capabilities that allow firms to automate tasks related to manual process of historical data, greatly increasing the capacity of data processing, and therefore, improving the quality of activities from customer

service to the development of new products. Thus, a better underwriting ecosystem can be built to improve the accuracy and efficiency of underwriting, mainly due to machine learning methods that support a better risk assessment. (Xie, 2018)

By leveraging big data and A.I. technologies to enhance claims management, insurers can decrease the time it takes for a claim to be handled, therefore, also reducing costs while improving customer experience, constituting a win-win situation. Accordingly, the implementation of machine learning methods can enhance damages and repair costs' evaluation through the analysis of preexisting information, as well as data from sensors and images. Moreover, A.I. capabilities such as great automation, self-learning and patterns associations can enhance insurers' ability to identify fraudulent claims. (Hall, 2017) Additionally, since artificial intelligence enables insurance to mine large scale of data, this capability can be used to screen risks and even identify trends of risk development. (Xie, 2018)

In conclusion, access to big data patterns combined with A.I.'s self-learning capability can provide opportunities for traditional carriers to provide enhanced and exclusive services to customers. Additionally, tailored insurance products might interest more prospects since they can be sold at fairer prices. Hence, AI will promote more personalized insurance products based on the incumbents' better understanding about their customers' needs. And it also creates the opportunity to increase insurers' cost savings, by speeding workflows, and new revenue streams as AI-driven analysis opens up new business and cross-selling opportunities. (Shroff , 2019)

4.4 Applications of artificial intelligence in claim management for fraud detection

Uncovering insurance fraud used to be a resource-intensive, arduous and costly process, in which claims agents had to rely on pure statistical models to identify fraudulent claims, therefore enhancing the possibility of frauds going undetected. However, as mentioned above,

artificial intelligence is transforming many processes within the industry's value chain, including claims management, by increasing its speed and accuracy. This improvement is due to technologies ranging from smart chatbots to the range of machine learning tools.

Nowadays, insurers can have access to the following applications of A.I.: to enable a real-time customer service for first notice of loss, automate claims fraud detection through rich data analytics, prediction of patterns of claim volume, and augment loss analysis. AI-based chatbots are one of the industry's biggest ally, since it can enhance the present claim process done by many employees while conducting claim reviews, verifying policy details and scanning the data through a fraud detection algorithm, before sending further payment instructions to the bank. Therefore, this application reduces human efforts from the client's side and saves workforce for insurance companies, while mitigating risks by detecting data patterns in claim reports and enhancing customer experience. (Makadia, 2019)

According to Jones , Humphreys, & Woolnough (2019), artificial intelligence and its subdisciplines can be allow the achievement of great automation and faster claim processes. IBM, the International Business Machines Corporation, a crucial player in the innovation ecosystem worldwide, has developed Watson Assistant, which is a chatbot with natural language processing. When this outstanding available technology joins another A.I. competence such as visual categorization and machine learning it can evaluate the accuracy and fair financial costs of a claim. IBM has also developed IBM's Power A.I. Vision, which is a tool capable of creating deep learning image recognition models and train them using labelled and augmented datasets to classify risks. Therefore, having access to large sets of data enables the innovation to improve its correctness, thus mitigating risks that could be developed using smaller data sets. Similar to IBM, other technological providers in the innovation landscape around A.I. are helping insurance companies to improve claims management processes, Table 1 in the Appendix describes some of these partnerships.

Fraudulent claims generate massive negative monetary impacts on businesses and individuals, as previously detailed, and consequently it also increases the value of charged premiums. Thus, it has another important impact to be considered that is the increase in payments to be made by policyholders. In this situation, loyal consumers are harmed, as are companies that, in addition to monetary loss, need to devote more time to review claims. Therefore, additionally to the monetary imbalance, this illegal activity perversely affects the basis of the insurance contract, which is the agreement between the parties. Yet, as society is now part of the digital age, in which customers from different generations, but mostly millennials and younger ones, seek for more digital, seamless and personalized experiences, the impact previously mentioned goes against new market trends. In conclusion, preventing and detecting fraud schemes leveraging more accurate and efficient methods, such as the ones available through artificial intelligence's implementation, must be a priority for insurance companies.

5. DISCUSSION

Since most academic papers and reports analyzed during this research focused on approaching cases from developed countries, when addressing the improvement of fraud detection in claim management through the adoption of AI-driven technologies, this section will introduce a discussion regarding Brazil.

5.1 Digital Transformation in the Brazilian insurance industry

As described previously, technological innovation offers a great opportunity for insurance companies, as it offers real and tangible advantages for an organization to reduce costs, increase efficiency, offer new services, create a better relationship with customers and prevent fraud. In Brazil, nowadays, insurance experts agree that this transformation is in the center of the industry's ecosystem, being through internal process automation or the development of personalized products.

According to Carlos Matta, partner of PwC Brazil, the existence of traditional insurance companies in the country relies on their capacity to create products that meet customers' needs and to reduce costs. However, digital transformation can initially be a painful process for large insurers since most of them still have obsolete operational systems that need to be updated in order to integrate new technologies, as explained by Luiz Fernando Butori, director of insurance in Itaú Unibancos. (Gonçalves, 2018) Gabriel Portela, CEO of SulAmérica, one of the biggest insurers in Brazil, attributes their positive and optimistic financial performance in 2019 to the current digital transformation process being applied in the company. While Marcelo Picanço, business and investment director at Porto Seguro, also credits technology as one of the main reasons behind internal efficiency gains and cost reduction achievements. (Tauhata & Furlan , 2019)

Based on the conducted market research, insurance customers in this country are also increasing their expectations toward more innovative and transparent companies. Therefore, the accurate and accountable treatment of the increasing amount of data is crucial to meet their needs. Nowadays, investing in digitalization provides insurers the following advantages: improvement in the contracting experience; acquisition of new consumers; maintenance of competitive advantage; development of innovative services; and better public recognition. (MJV , 2018)

5.2 The implementation of Artificial Intelligence in claim management for fraud detection in Brazil

According with 16º Ciclo do Sistema de Quantificação de Fraudes (SQF), in 2018 insurance claims in Brazil accounted for approximately R\$ 32.9 billion, of which R \$ 5.1 billion were the result of suspected claims. From the suspected claims, only 14.1% of its value was proven to be fraudulent, accounting for R \$ 723.2 million. Moreover, Table 2 in the Appendix shows

how fraud has been growing throughout the last years as well as the gap between the suspected fraud and the confirmed fraud.

Among the top 10 leading insurance companies in Brazil in 2017, based on net assets, as shown in Graphic 2 in the Appendix, only two insurers nowadays have clear projects regarding artificial intelligence, and they are not yet targeting fraud detection. Both Bradesco Seguros and SulAmérica implemented Watson Assistant technology, from IBM, focusing on enhancing customer experience through solving frequent questions they might have, while decreasing waiting time for calls and solutions. (IBM , 2019) HDI Seguros is a pioneer in fraud detection, in the country, with SAS technology for auto insurance, applying SAS Fraud Framework (SFF) and SAS Real-time Decision Manager (RTDM). These technologies predict the possibility of fraud in real time when the vehicle arrives for analysis in the automotive centers. (SAS, 2019)

5.3 Conclusion

After conducting a deep analysis about how the Brazilian traditional insurance market is fighting fraud in claim management through the implementation of technologies, such as artificial intelligence, it has been concluded that insurers from this country are lacking behind when compared to developed markets. They already have possibilities of partnerships with AI-driven technology companies from around the world, such as SAS and IBM, and also the knowledge available for internal research and development of such solutions. According to a research conducted by EMERJ in collaboration with Iron Mountain (2020), 46% of A.I. companies in insurance provide solutions for claims, and as of 2019 32% provide solutions for search and discovery and 16% provide solutions for optimizing claims payments.

It has also been concluded that the first step for Brazilian insurers toward the implementation of AI-driven solutions for fraud detection should be a better understanding about possible solutions' availability in the market and what is currently working for this specific industry,

before developing any implementation plan. In addition, since most large insurance companies still rely on large amount of paper in some sectors of the value chain, such as claims management, the second important step is digitizing claim forms using document digitalization software to speed up the process of carriers' employees manually having to enter the information from the client's scanned paper forms and updating essential software.

Thirdly, as traditional companies are still heavily dependent on obsolete internal systems, after eliminating as much paper process requirements as possible, updating their operational software will be vital for the adoption and integration of new technologies. Therefore, after the primary steps, once the company is better prepared for the implementation of innovative tools to enhance fraud detection, artificial intelligence currently provides solutions for claims management through process automatization and fraud detection with algorithms that can identify and learn from datasets patterns recognition to better recognize fraudulent claims. Additionally, it is crucial to the success of digitalization that companies include their employees throughout the process, thus also innovating the organization's culture.

Subsequently, as digitalization is a recent matter among most traditional sectors, specially insurance according to the reasons stated throughout this study, five interviews were conducted with current active professionals from the insurance sector in Brazil, as described in Table 3 and 4 in the Appendix, seeking to better understand the current digitalization scenario and why artificial intelligence has not been properly implemented to help detecting fraud, mainly in claim management. These professionals were chosen based on their expertise in this sector and because most of them either work for one of the biggest insurers or the biggest broker of the country.

All in all, the interviews positively validated the conclusions and recommendations stated along the previous analyses. According to the interviewees, only few large insurers are starting

to implement digital technologies to enhance internal processes while renewing the company's culture and way of developing new businesses ideas, including updated methodologies such as sprint canvas and design thinking; as well as their interactions with customers, seeking more agile strategies of online sale. The implementation of artificial intelligence in the companies' value chain is evidently far behind when compared to developed countries, and it is mostly focused on enhancing customer experience.

6. LIMITATIONS

Since the focus of this research is to study and analyze digital transformation in the insurance sector, as well as applications of artificial intelligence in this industry, it is very economic and business oriented. Nonetheless, digitalization and this specific technology might raise some social concerns, such as having an impact on people's behavior, or not respecting some ethical boundaries regarding monitoring. Those important topics in addition to A.I. principles were not able to be included in this research.

A.I. principles refer to the importance of obeying the rule of law and respecting its jurisdiction according to the country and sometimes states that the technology is being applied in. Those regulations concern not only trade practices but also accountability, discrimination, transparency and security (specially about the usage of private data) and promotion of fair access to insurance. (NAIC)

Another important limitation of this research is the lack of previous academic papers about artificial intelligence and its applications in the insurance industry, since they are very recent. In addition, as it is a very modern matter, the number of insurers applying these technologies are still small, therefore, the sample of analysis about the existing implementations in this industry usually had similar providers and innovations. And since data scientists are still

discovering possible applications of A.I. in our society, the applications described in this research are the ones available today.

7. FUTURE WORK

Based on the market analysis explained in the beginning of this study, the insurance industry is facing an unprecedented combination of high macroeconomic risks and important business opportunities worldwide. One important driver of this current scenario is customers' expectation, as they are increasingly searching for personalized solutions and seamless digital experiences. Therefore, the sector is attracting a number of technology-driven startups that are seeking to improve traditional processes within the business model, that enables cost reduction and new revenue streams, and deliver more customer-centric products in the current insurance ecosystem.

Insurtechs are important players in the insurance ecosystem today. According to Mueller (2018), they can be defined as “An insurance company, intermediary, or insurance value chain segment specialist that utilizes technology to either compete or provide value-added benefits to the insurance industry”. Over the past few years insurtechs have emerged in the insurance sector accelerating the use of technology and therefore having a transformative impact in the industry.

Major areas of impact include product development, distribution, underwriting and claims. In addition, the rise of insurtech presents opportunities for reciprocally valuable partnerships with incumbents, but they could also develop to be direct competitors. Therefore, the impact of insurtechs in the insurance industry, whether they are placing their companies as possible innovation partners or direct competitors to insurers, how they are digitalizing their value chain and how they are implementing artificial intelligence in their business models are relevant and interesting topics for future work.

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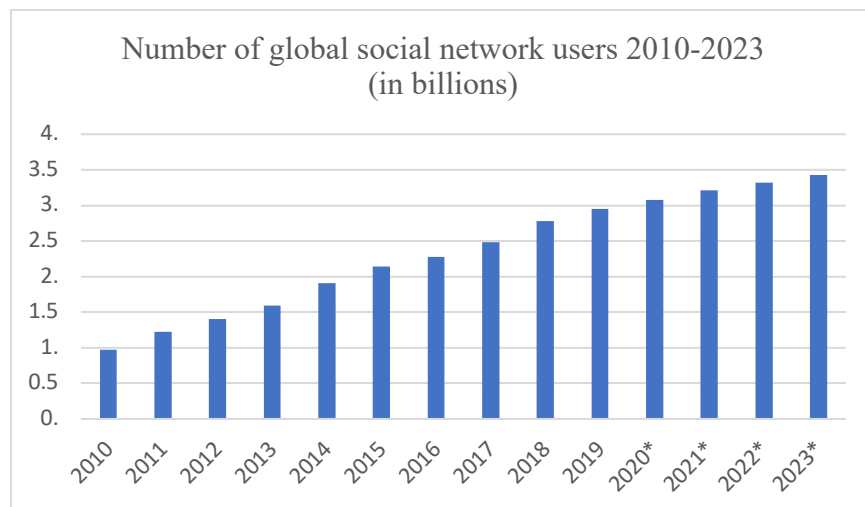
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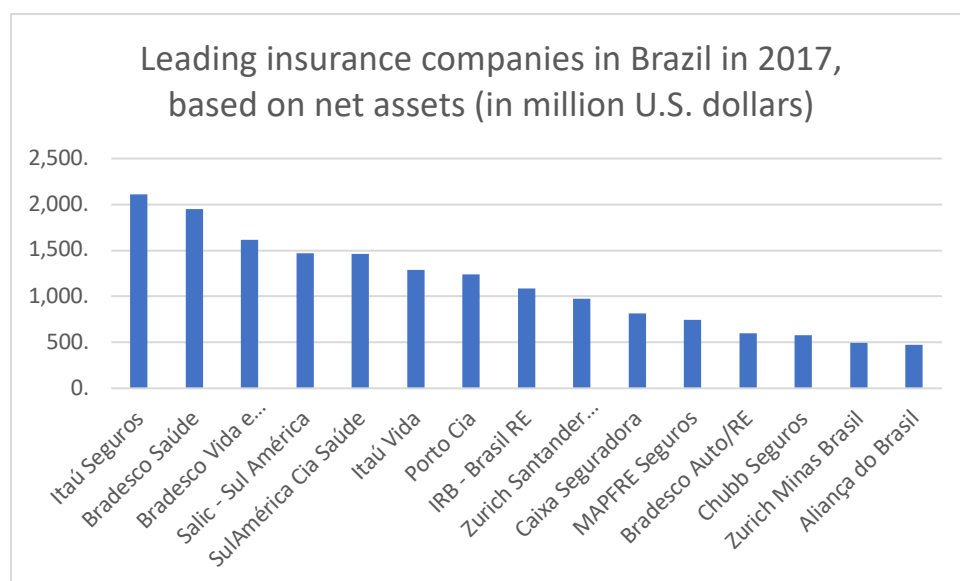
APPENDIX

Graphic 1: Number of global social network users 2010-2023 (in billions)



Source: Statista (2020)

Graphic 2: Leading insurance companies in Brazil in 2017, based on net assets (in million U.S. dollars)



Source: Statista (2017)

Table 1: Partnerships between insurance companies and AI-driven software providers.

Technology Provider	Example of partnership with insurance companies	Technology
Shift Technology	<ol style="list-style-type: none"> 1. CNA Financial 2. Cigna 3. Suravenir Assurances 4. Seguros Banorte 5. Generali France 	Force fraud detection solution: it's an automated, AI-native, SaaS solution that works with the client's existing claims platforms.
SAS	<ol style="list-style-type: none"> 1. Allianz 2. AKSigorta 3. Ayalon 4. ERGO 5. Ethniki 	SAS® Detection and Investigation for Insurance: it has capabilities ranging from data preparation to predictive analytics to financial reporting giving the insurer a complete solution for preventing opportunistic and professional fraud.
Friss	<ol style="list-style-type: none"> 1. Allianz 2. Folksam 3. InterAmerican 4. Signal Iduna 5. UNIQA 	Predictive analytics software: enables the company to gauge the fraud risk of a claim in real time.

Sources: Adaption from Shift Technology, SAS & Friss customer stories

Table 2: Fraud insurance percentages in P&C and life products in Brazil

Year	Suspected Fraud (%)	Detected Fraud (%)	Confirmed Fraud (%)
2012	7.80%	1.60%	1.20%
2013	9.00%	1.80%	1.50%
2014	11.20%	2.20%	1.70%
2015	13.70%	2.60%	1.80%
2016	11.80%	2.30%	1.80%
2017	15.70%	4.40%	2.20%
2018	15.60%	3.30%	2.20%

Souce: CNseg (2019)

Table 3: Interviewee Profile

Nome completo:	Cargo:	Empresa para a qual trabalha:
Alessandro V. Cogliatti	Superintendente CX	SulAmerica
Andressa Nascimento dos Santos Souza	Sales Coordinator	Qualicorp
Wanderson Barros	Comercial Manager	TOPFASE SEGUROS E BENEFÍCIOS

Gabriela	Manager	Bradesco Seguros
Ester Teixeira de Souza	Superintendente Comercial Regional	SulAmérica Seguros

Table 4: Interview

Nome completo:	1. Como você descreveria o atual cenário digital das grandes seguradoras brasileiras em geral? Na sua opinião, elas estão buscando serem mais tecnológicas internamente, junto aos seus colaboradores, e de forma externa, para melhorar a experiência do cliente?	2. A empresa na qual você trabalha busca desenvolver projetos de inovação para processos internos e para a melhoria da experiência do cliente? Se sim, poderia nos explicar um pouco sobre estes projetos?	3. Caso você trabalhe para uma seguradora, tem conhecimento de algum projeto que envolva Inteligência Artificial? Caso sim, poderia nos dizer qual é o objetivo deste projeto e da implementação desta tecnologia?	4. E por fim, na sua opinião, qual seria a melhor forma de introduzir a transformação digital em geral nas seguradoras brasileiras, as quais ainda possuem muitos processos arcaicos dependentes de papéis e re-trabalhos?
Alessandro V. Cogliatti	A movimentação é grande, todas buscando modernização condicionadas às suas capacidades de investimento. Cresce a possibilidade de parcerias com start-ups para acelerar a velocidade das entregas. Muitas divulgando cursos on-line, gratuitos, voltados a transformação digital.	Sim, temos foco nos 2 pilares, internos e externos. Os projetos nascem de experimentos utilizando metodologia ágil e focus group. Passamos por Fases do que chamamos de Design Thinking : Entendimento – primeiros passos, Observação – mas por quê? Ponto de Vista – hora da tomada de decisão, Qual caminho seguir?, Ideação – um mundo de possibilidades, Prototipagem – rápido, baixo custo, Teste – falar rápido para aprender rápido e Iteração. São desenvolvidos em SQUADS multidisciplinares.	Sim, nosso WhatsApp corporativo. Com a adoção de inteligência artificial, é possível conhecer as dúvidas mais comuns e oferecer as melhores respostas relacionadas à segunda via de boleto, informativo e prévia de reembolso, busca de rede médica referenciada, além de informações sobre serviços, como o Médico na Tela, e status da entrega domiciliar de medicamentos imunobiológicos e quimioterápicos orais. Objetivo toca na veia da experiência do cliente.	Ações de Cultura. Workshop. Comunicação e informação unificada em todos os pontos de contato com o cliente. Gamifications, criação de podcasts com especialistas e de uma garagem de inovação. Aumentar a tolerância a erros. Trazer os profissionais do front-office para desenhar as jornadas digitais com apoio de especialistas do mercado.
Andressa Nascimento dos Santos Souza	Sim. O cenário é desafiador para alguns padrões mais conservadores que primam o contato pessoal em 100% das relações. É benefício pq otimiza tempo, multi tarefas, eficácia, agilidade nos desafios contemporâneos. As relações P soluções de problemas ou busca de informações (interna e externa), ficam mais autônomas.	Sim. Formos os primeiros em nosso segmento a tornar a venda na 100% digital. Temos possibilidade de permitir maior transparência para o cliente, mais agilidade, e eficácia. Internamente houve uma devolução em todos os processos para o êxito da experiência! Mudamos a forma de pensar, agir e obter resultados. Quebramos paradigmas, mudamos. Mas o desafio é continuar inovando. A empresa tem treinado as equipes para o novo, para mudarmos conceitos preestabelecidos e estar em constante adaptação e inovação.	Não. Trabalho em uma Corretora/administradora.	Ousadia e determinação. Palestras explicativas, pontuação dos ganhos e ação... Todos resistimos um pouco no início, é natural, mas depois não lembramos em como era sem essa transformação.
Wanderson Barros	Acredito que apesar dos recentes investimentos em tecnologia o mercado brasileiro como um todo (seguradoras) ainda encontra-se muito aquém dos mercados mais maduros como norte americano e europeu quando o assunto é cenário digital. Acredito estarem sim buscando ferramentas tecnológicas internas, para se tornar mais eficiente e mais rentável com "menos" recursos humanos e em melhoria na experiência com clientes precisa evoluir bastante além do consumidor de seguros (Brasil) também precisa mudar sua cultura digital para este tipo de serviço.	Sim. Primeiramente estamos investindo em ferramentas para melhorias em nossos processos digitais internos e ferramentas de acesso dos nossos colaboradores, esperamos desta forma refletir positivamente na ponta (agregando valor ao nosso consumidor final).	Sim trabalho de forma indireta para todas as seguradoras nacionais e estrangeiras que atual no mercado nacional. Cito um projeto recente da Operadora Sul América Seguros no segmento plano de saúde onde o atendimento com cliente é realizado através de um aplicativo onde inicia-se com atendimento (robô) e através de palavras chaves leva o cliente a telemedicina, atendimento via vídeo de uma consulta médica sem a necessidade do paciente ter de se deslocar ao consultório, tudo acontece pelo celular.	A transformação digital é um caminho sem volta, as operadoras, seguradoras e todas as empresas envolvidas (direta ou indiretamente) na cadeia produtiva dos produtos e serviços (seguros) que não promovem este movimento, de certo estarão fora do mercado de forma natural. Creio que a que molhar forma de introduzir a transformação digital deveria ser de forma interligada, onde todos os elos da operação estejam em sintonia, pois o mercado de seguros no Brasil é composto de muitos prestadores de serviços que anualmente com as grandes seguradoras, em função disto, as seguradoras precisam investir em toda cadeia produtiva para que a transformação digital chegue e atinga o consumidor final.
GABRIELA	As seguradoras tem buscado um lugar no mercado utilizando-se para isso de mais tecnologias melhorando cada vez mais tanto os processos de trabalho quanto o atendimento ao cliente	sim estamos cada vez mais buscando ter como aliada a tecnologia e para isso a gente tem implementado processos mais tecnológicos buscando a inovação principalmente trabalhando através de sprints Canvas visando a melhoria dos processos internos que por consequência melhora o nosso produto e avaliação do cliente e a experiência que o mesmo tem com os nossos produtos estamos trabalhando com ilhas de desenvolvimento em todos os produtos criando times multidisciplinares para melhorar a visão do todo. Interagindo todas as áreas.	Sim temos a Bia que atende tanto canal banco quanto o canal da seguradora Bradesco seguros o objetivo é fazer com que o cliente tanto o corretor quanto o cliente externo né que é o corretor e o cliente final consumidor de produtos consiga ter alcance das mãos as informações necessárias para esclarecer dúvidas esclarecer e sanar dúvidas e consiga sair satisfeito com um atendimento.	eu acredito que é seguradora que ainda não está aliada ao processo tecnológico está bem próximo de fazer isso. o mundo se tem se tornado cada vez mais tecnológico os clientes exigem essa tecnologia e quem ainda não aderiu certamente não futuro bem próximo vai fazer isso por exigência do mercado para sobreviver
Esther Teixeira de Souza	Estamos caminhando neste sentido mas ainda temos grandes seguradoras que precisam avançar no cenário digital.	Sim, a transformação digital na nossa empresa é intensa e permeia todas as áreas, não só na atualização de sistemas mas também nas metodologias de processos.	chat bot para atendimento aos clientes, objetivo agilidade e eficiência.	Iniciar trabalhando a cultura da organização para que ocorra uma mudança de mindset, introduzindo conceitos como Lean, design thinking....